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REDUCING TUBES OVER A STEPPED MANDREL TO MANUFACTURE TUBU-
LAR SHAFTS HAVING AN UNDERCUT IN ONE OPERATION

PATENT CLAIMS

1. A method for manufacturing hollow shafts (11') having end portions (12', 16) of greater wall thickness and at least one intermediate portion (14') of reduced wall thickness, from a tube (11) having constant wall thickness using a mandrel (21) having diameters stepped over its length, which has a first longitudinal section (22) having a smallest diameter and at least one further longitudinal section (24) having a further larger diameter,

having the following steps:

reducing the external diameter of a first portion (12) of the tube (11) over the first longitudinal section (22) of the mandrel (21) to produce the first end portion (12'),

reducing the external diameter of at least one middle portion (14) of the tube (11) over the at least one further longitudinal section (24) of the mandrel (21) to produce the at least one second intermediate portion (14'),

reducing the external diameter of a further portion (16) of the tube (11) over another longitudinal section (22) of the mandrel (21) to produce the second end portion (16).

2. The method according to Claim 1,

characterized in that the first end portion (12') and one or more intermediate portions (13', 14') of the

hollow shaft (11'), having a reduced wall thickness in each case, are produced with an unchanged axial position of the mandrel (21) in relation to the tube (11).

3. The method according to one of Claims 1 or 2,

characterized in that the second end portion (16) is produced over the first longitudinal section (22) of the mandrel (21).

4. The method according to Claim 3,

characterized in that one or more further intermediate portions (15'), each having an increased wall thickness, and the second end portion (16') are each produced with a changed axial position of the mandrel (21) in relation to the tube (11), drawn out step-by-step from the tube (11).

5. The method according to Claim 3,

characterized in that at least two second intermediate portions (15', 14₂'), alternately having first increased, then reduced wall thickness, are produced - particularly with an unchanged axial position of the mandrel (21) in relation to the tube (11) in each case.

6. The method according to one of Claims 1 through 5,

characterized in that the reduction of the external diameter of the tube (11) is performed through cold drawing using a matrix (31), through which the tube (11) is guided from one tube end (12), tube (11) and mandrel (21) jointly on one side and matrix (31) on the other side moving axially in relation to one another.

7. The method according to one of Claims 1 through 5,

characterized in that the external diameter of the tube (11) is reduced through swaging, roll bending, or rolling.
8. The method according to one of Claims 1 through 7,

characterized in that transition areas (17, 20) between end portions (12', 16') and intermediate portions (13', 15') and transition areas (18, 19) between intermediate portions (13', 14', 15') of different wall thicknesses are formed by internal conical surfaces having a cone opening angle between 5 and 45°.
9. The method according to one of Claims 1 through 8,

characterized in that the wall thickness ratio between the end portions (12', 16') and the intermediate portion (14') of smallest wall thickness is greater than 1.6.